United Nations A/C.2/54/7

General Assembly

Distr.: General
17 November 1999
English
Original: Spanish

Fifty-fourth session
Second Committee
Agenda item 100 (b)
Environment and sustainable development: International Decade for Natural Disaster Reduction

Letter dated 4 November 1999 from the Permanent Representative of Ecuador to the United Nations addressed to the Secretary-General

Further to my letter 4-2-129/98 dated 27 November 1998 (A/C.2/53/10), and in relation to General Assembly resolutions 52/200 of 18 December 1997 and 53/185 of 15 December 1998 and Economic and Social Council resolution 1999/46 of 28 July 1999, on international cooperation to reduce the impact of the El Niño phenomenon, I am transmitting to you a study assessing the feasibility of establishing an international centre for the research of the El Niño phenomenon in Guayaquil, Ecuador (see annex).

I should be grateful if you would have the study transmitted herewith circulated as a document of the Second Committee under item 100 (b) of the agenda of the General Assembly.

(*Signed*) Mario **Alemán**

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Annex

World Meteorological Organization

Feasibility study

El Niño Centre, Ecuador

J. P. Bruce

1. Introduction

Pursuant to General Assembly resolution 52/200 of 18 December 1997 on international cooperation to reduce the impact of the El Niño phenomenon, a major international conference was held in Guayaquil, Ecuador, from 9 to 13 November 1998. On 27 November 1998 the Ecuadorian authorities submitted to the General Assembly the Guayaquil Declaration resulting from that conference (A/C.2/53/10, annex). The Guayaquil Declaration requests "immediate action to assess the feasibility of establishing an international centre for the research of the El Niño phenomenon, in Guayaquil, ... within the context of the United Nations Inter-Agency Task Force on El Niño". The results should "be reflected in the report on the implementation of the United Nations General Assembly draft resolution A/C.2/53/L.30 to the next session of the General Assembly through the 1999 substantive session of the Economic and Social Council". The World Meteorological Organization (WMO), through its Secretary-General, Mr. G. O. P. Obasi, recognized the urgent need to carry out the feasibility study requested and, to that end, organized a mission from 28 January to 7 February 1999. The mission included consultations with the New York-based International Research Institute for Climate Prediction, which has institutes and senior officials in Quito and Guayaquil, and with the relevant international institutions. A summary of the consultations appears in the appendix.

This feasibility study describes the scientific and organizational context, the scope and functions of the Centre, a suitable location, the staff and equipment required, and a proposed organizational agreement. It outlines the contributions that Ecuador would be likely to make and the magnitude and nature of the external resources required.

2. Global scientific and organizational context

The 1980s and 1990s have seen a remarkable increase in scientific capacity to make predictions about average climate conditions a season or more in advance. Much of the progress has been due to international cooperation in the framework of the WMO World Climate Research Programme, the Intergovernmental Oceanographic Commission (IOC) and the non-governmental International Council of Scientific Unions (ICSU).

It is now recognized that large-scale natural modes of ocean-atmosphere interaction strongly influence seasonal and even annual climate conditions in most parts of the world. Among them is the El Niño-La Niña Southern Oscillation Phenomenon (ENSO) in the tropical Pacific, the northern Atlantic and the northern Pacific, as well as fluctuations in other ocean regions. The strongest of these, which has a significant impact on many countries, is ENSO. The 1997-1998 El Niño event was the strongest on record. It caused huge losses due to drought in the western tropical Pacific and in north-eastern Brazil, and

disastrous floods, with losses to agriculture and fisheries, in western South America and elsewhere.

In order to predict seasonal conditions worldwide, there is a need for an international centre with the fastest and most powerful computers and a highly trained staff to take into account the various ocean-atmosphere modes. Such centres exist already in the International Research Institute for Climate Prediction and the European Centre for Medium-Range Weather Forecasts in the United Kingdom, among others. If, however, global predictions are to be more relevant to users, international regional centres making downscaled global predictions are needed, in order to make projections on a much smaller scale and to assist in developing appropriate regional response measures in socio-economic sectors, such as agriculture, health, water, disaster mitigation, fisheries and energy production and use. Measures have been taken to establish such centres in Africa (Drought Monitoring Centres in Nairobi and Harare, African Centre for Meteorological Applications to Development in Niamey), and there are cooperation agreements in the south-western Pacific region in which Australia participates.

3. Scope of the El Niño Centre

It is urgent to establish a centre focusing on ENSO and the applications of predictions thereof, especially in South America. Such a centre would work in close cooperation with global and other regional centres.

3.1 Information products to meet needs

On the basis of the meetings and consultations summarized in the appendix to this report, and on the assumption that the needs of other countries in the region are similar to those of Ecuador, the Centre should develop sufficient capacity to prepare the following types of products:

(a) Results of research on downscaling techniques in the region;

(b) Results of research on the sensitivity of various socio-economic sectors to climate variability;

(c) Continual updating of estimates of the frequency with which extremely heavy rains, floods, droughts, high temperatures, and other climate-related events occur, with a view to the safe and efficient design of bridges, roads, buildings, and so on;

(d) Downscaled projections of the status of ENSO and its weather and climate implications for the next three to six months;

(e) Seasonal advisories and warnings for general users, issued on a monthly basis;

(f) Seasonal advisories and warnings geared to the needs of various sectors, including emergency preparedness, agriculture, fisheries, health, tourism, water and energy.

3.2 Dissemination of products and relations with the National Meteorological and Hydrological Services (NMHSs)

The Centre should conclude formal agreements with each NMHS concerning the dissemination of products, the division of efforts so as to avoid duplication, and exchanges of data and staff. In the dissemination of the Centre's products, the following guidelines are recommended:

(a) The main vehicle for disseminating the Centre's products in each country would be the NMHS, which could in some cases add value to the regional projections, thanks to its local knowledge;

(b) The Centre would transmit monthly bulletins to the NMHSs and to others on an agreed mailing list, and would place the contents of the bulletin on an accessible Web site;

(c) The Centre would disseminate products directly to regional organizations, such as the Disaster Management Training Programme, the United Nations Development Programme (UNDP), the Pan American Health Organization (PAHO), the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), and so on.

Exchanges of staff between the NMHSs and the Centre should be encouraged for training purposes and to ensure a good understanding with respect to the possibilities, limitations and optimum uses of the products.

4. International linkages

4.1 Climate Information and Prediction Services (CLIPS-WMO)

This WMO programme assists countries, through training and exchanges of information, in the application of data and climate predictions in order to improve economic efficiency and promote measures to achieve sustainable development. It views climate as both a resource and a risk. An El Niño centre in Ecuador would serve as a CLIPS regional office.

4.2 Climate Variability and Predictability (CLIVAR), World Climate Research Programme (WMO)

Valuable contributions can be made to CLIVAR, the international research project derived from the study of the year-to-year variability of the tropical oceans and global atmosphere (Tropical Ocean and Global Atmosphere Project — TOGA) which led to the capacity to predict ENSO, by paying special attention to the measurement and understanding of ENSO characteristics in the eastern Pacific.

4.3 Framework Convention on Climate Change (FCCC)

Under this Convention, countries have agreed to cooperate in climate science and in actions to reduce greenhouse gases and the harmful effects of climate change and variability (and to take advantage of the beneficial effects). The financial mechanism within the Convention is the Global Environment Facility (GEF), which has been used to assist developing countries in reducing emissions and adapting to climate change, the rise in sea levels and climate variability. A vital scientific question at present is whether the increased climate forcing resulting from greenhouse gases is causing and/or will cause an increase in the intensity or frequency of El Niño. According to recent studies, the intensity of El Niño has increased in the past century, as measured by deviations from the normal sea surface temperatures during the July onset period (J. Shukla, 1977 World Climate Research Programme Conference, fig. 1). Some studies attribute this, at least in part, to greenhouse gas forcing, and suggest that there will be a continued intensification in the future (see, for example, Knutson and Manabe, *Journal of Climate*, September 1998).

4.4 International Decade for Natural Disaster Reduction (IDNDR) (1990-1999)

During this Decade proclaimed by the General Assembly in its resolution 44/236 of 22 December 1989, national efforts and international coordination have centred on reducing human and economic losses due to natural disasters through prevention and preparedness measures. A better understanding of ENSO is needed in order to establish safe but economical design criteria with respect to heavy rainfalls and floods. It is necessary to do this in view of the billions of dollars which the rebuilding of bridges, roads and drainage systems under way in Ecuador and neighbouring countries is costing. Better and smaller-scale predictions of El Niño and La Niña phenomena would contribute directly to more effective preparedness measures to prevent the loss of human lives and reduce economic losses.

5. Regional linkages

5.1 Permanent South Pacific Commission (CPPS) (Colombia, Chile, Ecuador and Peru)

CPPS has established a cooperation programme for research on El Niño (Programme for the Regional Study of the El Niño Phenomenon in the South-Eastern Pacific) (ERFEN) with the participation of several institutes in the four countries that are studying ENSO and its effects. The Ecuadorian Committee for ERFEN has significantly facilitated all aspects of this feasibility study.

5.2 Prevention of losses caused by disasters

A UNDP regional office is located in Quito, Ecuador, and PAHO has active programmes to mitigate the impact of disasters on the region. The IDNDR Regional Unit for Latin America and the Caribbean is in Costa Rica. By assisting the national disaster management bodies and participating in their activities, all organizations can benefit from a larger number of region-specific predictions of El Niño and La Niña.

5.3 WMO Region III (South America)

This regional organization for South America helps to prepare, coordinate and support national activities to monitor climate and hydrological conditions, transmit information, train specialized staff and predict weather, climate and hydrological conditions. WMO Regional Association III can facilitate cooperation and support from other South American countries for this Ecuadorian initiative.

The National Institute of Space Research (INPE) of Brazil has powerful computers and makes some regional predictions. There will be a need for a cooperation agreement between a centre in Ecuador and INPE.

6. Summary of the national situation in Ecuador (see appendix also)

In Ecuador, the main governmental organizations of ERFEN for data, research and applications concerning El Niño are the Naval Oceanographic Institute (INOCAR), the National Meteorological and Hydrological Institute (INAMHI) and the National Fisheries Institute (INP). INOCAR has a small ENSO unit which periodically issues an updated prediction of ENSO conditions on behalf of ERFEN. This unit uses global projections from the International Research Institute for Climate Prediction (IRI) and elsewhere, and uses

statistical, rather than dynamical, prediction methods for downscaling. INOCAR operates a large oceanographic research vessel and conducts hydrographic surveys and mapping. INAMHI has published two valuable volumes on the 1997-1998 El Niño event, one on meteorological data and analysis, and the other on hydrological data. Unfortunately, most of the INAMHI hydrometric stations were lost in the 1997-1998 floods. INAMHI provides secretariat services for the national programme on climate change directed by the Department of the Environment. INP has a modest research vessel and carries out El Niño-related research on fisheries. Shrimp (Ecuador's third largest export) thrive under El Niño conditions, but fishmeal producers who use sardines and the like are on the verge of bankruptcy. Nevertheless, stormy conditions limit fishing activities and cause damage to coastal roads and installations vital to the industry.

Three Guayaquil universities which carry out El Niño-related research are also represented in ERFEN. The Coastal Zone Polytechnic Institute (ESPOL) has an active programme in Ecuador and throughout Latin America on the impact of El Niño and adjustment to it. It has a special office for international projects, the Centre for Provision of Services, and has funds provided by the Inter-American Institute (II) for several El Niño-related projects. The Catholic University specializes in socio-economic studies, and is a key partner in a $14 million World Bank study designed to produce a master plan and set priorities for the roads and bridges rebuilding programme, valued at over $1.2 billion (see CORPECUADOR, below). The University of Guayaquil, with 45,000 students, has an active natural sciences programme, comprising the study of the bacteria, benthic organisms and phyto and zooplankton along Ecuador's coasts that are influenced by ENSO fluctuations. Other important bodies on the ERFEN Committee, or users of its information, are Civil Defence (disaster management, not much prevention), CORPECUADOR, which is responsible for the major reconstruction tasks following the 1997-1998 El Niño event ($100 million has been spent and another $1 billion is needed), the Department of Agriculture and the Department of Fisheries. All those institutions and departments, with the exception of INAMHI headquarters, are located in Guayaquil. INAMHI and other national headquarters of governmental departments are located in Quito and have regional offices in Guayaquil. In sum, there is a large concentration of El Niño-related expertise in Guayaquil which can provide substantial support to the Centre.

All the senior officials consulted, from the Secretary-General of the Office of the Vice-President to the Minister of Energy (INAMHI) and the under-secretaries of agriculture and fisheries, have expressed the Government's firm commitment to supporting an El Niño centre in Guayaquil. The Ambassador of CPPS gave assurances that CPPS countries would support Ecuador's initiative.

7. The impact of El Niño

This firm support from senior public officials demonstrates recognition of the tremendous damage done by the 1997-1998 El Niño event, estimates of which have varied from $3.5 billion to $4 billion, including $2 billion for roads, bridges and drainage systems and $1.5 billion to $2 billion for agricultural and fishery losses. Other countries in the region have suffered similar losses. The record of the incidence of malaria in Colombia (fig. 2) shows marked increases in the El Niño years, which indicates that the health implications for the region can be substantial. Given losses of that magnitude, public officials are of the view that in Ecuador alone, even with a 1 per cent or 2 per cent reduction in losses, a centre would pay for itself several times over.

8. Organization of the Centre

A suggested organigramme of the Centre appears in figure 3. It is proposed that the Director be designated through an international competition and chosen by the Council of Administration and Sciences. The Director would report to a Council of Administration and Sciences appointed by the principal co-sponsoring organizations (WMO, IOC, CPPS, ERFEN-International, ERFEN-Ecuador) and by representatives of the largest resource-contributing countries and organizations. In order to avoid having two administrative or consultative bodies, one for administration as such and one for sciences, such organizations should be encouraged to designate distinguished scientists to serve on the Council. Each organization can designate two persons, one for administration and the other for sciences. The organizations represented should pay the travel costs and other costs of their representatives.

The main scientific work of the Centre would be carried out by two major interdisciplinary divisions. One would be responsible for ENSO research and mathematical modelling, especially the adaptation of existing models to make it possible to downscale global forecasts; the other division, on predictions and applications, would be responsible for information activities and the development of products that the Centre could use. It would make regular predictions in formats specially designed to meet the needs of various socio-economic sectors in the region. Initially, this could be based on techniques developed in INOCAR and through arrangements with INPE (Brazil). A staff composed of sector liaison specialists would be responsible for maintaining close contact with their respective sectors in Latin American countries. A small administration division would be required, and the establishment of a communications and observations office, responsible for ensuring the proper high-speed transmittal of data and information needed by the Centre and establishing communications facilities to disseminate the Centre's information products, including an appropriate Web page, would be recommended. Such an office would also encourage and coordinate the installation, maintenance and standardization of the observation networks required for the work of the Centre. Such observations would also help to improve global predictions.

9. Staff and budget

Table 1 contains an initial description of the staff and equipment. Ecuador's annual contributions for staff salaries, services, equipment, installations and other operating costs appear in the first two columns. The total commitment of existing and expanded resources is equal to $1.273 billion, which would ensure the operation, functioning and maintenance of the Centre. The resources which must be obtained from external sources to cover payments to the Director and the Executive Assistant, a fund for contracting work with other institutions in the region, and contributions for training and for equipping the Centre are shown in the next two columns. It should be noted that equipment maintenance appears in the budget of the host country.

Tables 2-A and 2-B contain the breakdowns of the national counterpart amounts which appear in table 1, to be provided through the institutions that make up the National Programme for the Regional Study of the El Niño Phenomenon (ERFEN).

Table 2-C presents a summary of the institutional contributions and the annual and overall cost represented by the national counterpart for the installation, implementation and operation of the Centre during the first 10 years of operation. Financing for the Centre will

be delivered by the Government in accordance with the statement made by the Vice-President in his letter No. 0103 of 18 May 1999. Estimates of the international contributions appear in table 2-D.

The proposal for support for the resources provided by Ecuador is based on the assumption that all key staff will be recruited by the Centre. It is very possible, however, that countries in Latin America and elsewhere may be willing to send specialists to the Centre for varying time periods. This could increase the core staff listed, and could also be used to fill one of the identified core staff positions that are listed in table 1, thus reducing the host country requirements.

It is recommended that the Centre be installed in a building on the INOCAR campus in Guayaquil that is currently used only on a part-time basis. It consists of four rooms of 80 m^2 each, which could be subdivided, and a much larger room which now functions as an auditorium, but which has a flat floor. It has air-conditioning and is equipped with lavatories.

It is expected that much of the teaching and training can be imparted with the support of IRI in New York and can be charged to the regular budgets of WMO and the United Nations Educational, Scientific and Cultural Organization (UNESCO) (IOC), making substantial use of the universities and educational institutions in Guayaquil.

10. Duration of the project

The initial period of operation of the Centre is 10 years, after which it should tend towards self-management, with contributions from the private sector in particular.

11. The next steps

This feasibility study is but the first step in a series of actions necessary to make the Centre a reality. An outline and a timetable of key actions to be taken prior to the next session of the Economic and Social Council in July and the General Assembly's review of a plan at its fifty-fourth session are given below.

11.1 Timetable

26 February	Review and translation of the report on the feasibility study by the WMO secretariat and the Region III office and referral of revised study to the Permanent Representative of Ecuador and other authorities and to CPPS for their comments.
As from 8 March	Meetings between WMO and UNDP staff in Geneva to discuss the strategy for seeking external resources. Discussions with the secretariats of other United Nations agencies and of the International Decade for Natural Disaster Reduction.
March	Presentation by WMO to the United Nations Inter-Agency Task Force on El Niño.
March	Ecuador obtains agreement on and begins to develop cooperative arrangements with other countries in the region through the special El Niño meeting for WMO Region III (South America) to be held in Lima, Peru, and through CPPS.

April/May	WMO and Ecuador meet with CPPS in order to prepare a detailed project document aimed at seeking firm resource commitments.
July	Presentation of proposal by WMO and the Inter-Agency Task Force, CPPS, and Ecuadorian senior officials at the session of the Economic and Social Council to be held in Geneva.

11.2 Potential international support

Various kinds of support for the Centre might be requested from the following international organizations:

- United Nations Development Programme, particularly its Disaster Management Programme;
- Global Environment Facility;
- Economic Commission for Latin America and the Caribbean;
- Organization of American States;
- Inter-American Institute for Global Change; and
- International Research Institute for Climate Prediction (IRI) (Office of the Global Programmes of the National Oceanic and Atmospheric Administrations (NOAA)).

National donors and foundations could also be requested to contribute in various ways.

Appendix

Reports on various meetings and consultations

(In chronological order)

1. International Research Institute for Climate Prediction, Palisades, New York, 28 and 29 January 1999

Antonio Divino Moura, Director, Phillip Arkin, Deputy Director, and other IRI staff members provided a valuable briefing on the development of IRI and the types of products, training and support it could provide to an El Niño centre in Ecuador. The Institute's Web site digest provides overall global predictions, an indication of possible deviations from normal climate patterns and some potential effects on a broad geographic scale. Its training and workshop programme could be of major benefit. Divino Moura indicated that IRI would be very supportive of a centre in Ecuador that would focus on downscaling ENSO predictions in developing applications to major socio-economic sectors in South America. Preliminary work is under way on a new $10-million IRI headquarters building, overlooking the Hudson River.

2. First meeting with representatives of WMO-Ecuador Co-ordination Committee for the Regional Study of the El Niño Phenomenon (ERFEN), at the headquarters of the National Meteorological and Hydrological Institute (INAMHI), Quito, 31 January

The Executive Director of INAMHI, Mr. Nelson Salazar Delgado, and his Deputy Director, Mr. Carlos Lugo Freise, welcomed the Committee and WMO representatives to INAMHI headquarters. Members of the Committee briefed the WMO representatives on its progress. The WMO representatives outlined the nature of the feasibility study being prepared on their mission, and the schedule of visits was discussed. Salazar presented the Committee's proposed concept of a centre for consideration by the WMO consultant. They suggested calling it the International Centre for the Research of the El Niño Phenomenon. While some Committee members still had a global centre in mind, after some discussion, they agreed on a scope that would focus on downscaling ENSO predictions for applications in South America. It was felt that some recent scientific results linking increases in ENSO intensity to greenhouse gas forcing lent urgency to the creation of a centre.

3. UNDP, Quito, 1 February

Ms. Anse Smedler, Resident Representative, and José Vicente Troya R. met with two senior INAMHI officials and WMO representatives. Unfortunately, Mr. Mena from the regional office of the Disaster Management Programme had been prevented from attending by the Colombian earthquake disaster. The UNDP representatives expressed great interest in an ENSO centre based in Ecuador because of the potential for reducing huge losses in, *inter alia*, infrastructure, fishing and agriculture. Although they were non-committal about financial support, they did want to receive the feasibility study and keep close track of the proposal's development.

4. Secretary-General of the South Pacific Permanent Commission (CPPS) (parent body of ERFEN), Quito, 1 February

Ambassador Fabián Valdivies and his staff gave assurances that the four CPPS countries supported the Guayaquil Declaration and the establishment of an international centre in Guayaquil. He, too, envisaged a truly global centre; however, after discussion of developments in IRI, the European Centre for Medium-range Weather Forecasts (ECMWF), and the Drought Monitoring Centre (DMC) in Nairobi, he was prepared to accept a scope that was more limited geographically but placed strong emphasis on reducing the socio-economic impact in CPPS countries and their South American neighbours. He expressed deep satisfaction at the rapid response of WMO and its Secretary-General, Mr. Obasi, to the Guayaquil Declaration and to the General Assembly resolution by launching this feasibility study.

5. Minister of Energy, Quito, 1 February

Mr. Patricio Ribadeneira, Minister of Energy, is in charge of the Ministry that includes INAMHI. He stated that the Government of Ecuador is strongly committed to supporting a centre that is international in scope and was particularly interested in the potential value of ENSO predictions in achieving efficiencies in a possible integrated hydro-electric grid between Colombia, Ecuador and Peru. Hydroelectric power is the source of 65 to 90 per cent of Ecuador's electricity, depending on whether it is the dry or wet season.

6. Office of the Vice-President, Quito, 1 February

Iván Viteri Miranda, Secretary-General of the office of the Vice-President, also gave strong assurances of the Government's interest and willingness to provide support; he noted, however, that Ecuador is having serious budgetary problems. He wanted to know how much of Ecuador's contribution might come from existing resources and how much might require new resources. He said that the feasibility study should provide initial estimates of the support required from Ecuador in either form, and of the support that would be required from external sources. He wished to arrange a meeting of the Vice-President with INOCAR and INAMHI representatives in order to discuss the matter within a period of approximately two weeks. (INOCAR is the Naval Oceanographic Institute in Guayaquil, and the logical location for the Centre. Its Director is Chairman of ERFEN.)

7. Technical staff of Emergency Management Group in Civil Defence, Quito

Nelson Válquez of this Group provided an overview of national and regional disaster preparedness activity. While there is not much emphasis on prevention, active public information programmes are being carried out to encourage disaster preparedness. He welcomed and supported the initiative for an El Niño centre.

In Guayaquil

8. Naval Oceanographic Institute (INOCAR)

This well-equipped Institute, with some 200 employees, headed by Captain Fausto López Villega (Chairman of ERFEN), is located in the Ecuadorian Naval complex in Guayaquil. It operates a major research vessel, "Orion", and several smaller vessels for nearshore studies and hydrographic surveys. Most of this work is carried out in Ecuadorian waters but Orion makes periodic cruises to the Antarctic. INOCAR already operates an El Niño office in which global predictions are downscaled statistically for an El Niño bulletin and Web page. Its cruises sample physical, chemical and biological conditions and are complemented by some seven coastal water-level and meteorological stations. Hydrographic charting is gradually being automated. As one of the buildings on its campus is only partially occupied, four 80 m^2 rooms and a large conference room, all with air conditioning and other facilities, could be made available for the international El Niño Centre.

The Naval Oceanographic Institute also has a Web page which is updated on a daily basis with data from oceanographic and coastal stations and from outside the region. A monthly Climatic Warning Bulletin (BAC) contains information from the Institute's own database and oceanographic and meteorological data supplied by member countries of CPPS. The Bulletin is also accessible on the INOCAR Web site.

9. National Fisheries Institute (INP)

This Institute, founded in 1960 with assistance from the Food and Agriculture Organization of the United Nations (FAO), has, since 1967, been independently operated by about 110 Ecuadorian employees. Its research activities include:

(a) aquaculture;

(b) basic population studies and evaluation of fishing resources; and

(c) environmental pollution in coastal areas.

It also ensures the quality control of export products. The Institute operates a moderate-sized research vessel for sampling, primarily of biological and chemical matter. Shrimp (*camarones*) are Ecuador's second or third largest export (after oil, and, sometimes, bananas), and, despite physical damage to aquaculture, dock and coastal roads, tend to thrive in El Niño conditions. There have been heavy losses in sardine fishmeal products, and during El Niño, small-scale fishermen are able to catch only one or two of the larger species. The Institute is an active participant in ERFEN. It has financial difficulties because it is not the recipient of the private-sector funds paid for its quality control inspections. INAMHI is experiencing similar problems.

10. Under-Secretary of Agriculture and CLIRSEN

This highest-ranking official of the Department of Agriculture in the coastal provinces of Ecuador estimated that agricultural losses caused by El Niño in 1997-1998 were on the order of $1.5 billion. He is very concerned about being better prepared next time and sees an international centre as key in this regard. He promised strong support for any request to the Ecuadorian Government and said he would seek financial support for the Centre from

industry and agricultural cooperatives. CLIRSEN is part of the Department of Agriculture; Ms. Pilar Icaza gave a briefing on its capabilities. The role of CLIRSEN is to study natural resource issues through the use of remote sensing. It has facilities for receiving, analysing and reproducing images from Landsat, SPOT and NOAA polar orbiters. Destruction of forests in the Amazon basin in Ecuador and of coastal mangroves is being monitored. CLIRSEN has provided special images and analyses to CORPECUADOR (see para. 11) for use in planning the reconstruction of roads and bridges.

11. CORPECUADOR

This is a special agency created for the reconstruction of roads, bridges and drainage facilities damaged by El Niño. The design criteria and priorities of this programme totalling $1.2 billion, of which $100 million has already been spent, is the subject of a $14.5 million study being financed by the World Bank and carried out by Catholic University and foreign consultants. Unfortunately, CORPECUADOR was unaware of the excellent hydrologic study of the 1997-1998 floods carried out by INAMHI; however, as a result of our visit, the Director, Nelson Salazar, was invited to meet with the consultants to provide input. Although they are currently reconstructing in the aftermath of the huge 1997-1998 floods, they are concerned about the possibility of ENSO intensifying with increased greenhouse gas forcing.

12. Catholic University

The President, Mr. Jorge Toa Miranda, is also a Vice-President of CORPECUADOR. As noted above, the University is deeply involved in the World Bank study, particularly its socio-economic aspects, and in priority-setting. Its work generally focuses on the social vulnerability dimension of disasters and on reconstruction, and this is the perspective it provides to ERFEN.

13. Under-Secretary of Fisheries

Mr. Luis Torres Navarette, senior adviser to the Under-Secretary, noted that 25 per cent of Ecuador's coastal population is engaged in fishing or the manufacture of fish products. A new fisheries law under consideration will place greater emphasis on environmental protection. He attended the Guayaquil Conference on El Niño in November and thinks that his Department and the fishing industry would provide resources to support an international El Niño centre in Guayaquil.

14. Coastal Zone Polytechnic Institute (ESPOL) and Centre for Scientific and Technical Research (CICYT)

Dr. José Luis Santos D., Director of CICYT, and María Pilar Cornejo, a well-known physical oceanographer who chairs the WMO-IOC-ENSO Panel, described the extensive work of ESPOL. Many members of the scientific staff of INOCAR were trained at ESPOL. Its scientific projects cover the geographical area from Cuba to southern South America; some of them were funded by the Inter-American Institute. It has excellent computer training facilities, has developed an expert system for reducing agricultural losses from El Niño, and a Geographical Information System (GIS) for designating flood plains (vulnerability

charts). It issues a monthly ENSO bulletin tailored to the needs of farmers and other users. It is an active participant in ERFEN.

15. University of Guayaquil

This is a large institution with 45,000 students, 1,000 or more of whom are enrolled in the Faculty of Natural Sciences (Mr. Rafael Emilio Valdez Requena, Geologist, Assistant Dean). Its research and research-related teaching are focused on marine coastal areas. It is carrying out studies of the impact of El Niño on toxic chemical concentrations (pesticides, trace metals), benthic fauna, bacterial populations and primary biological production. It, too, actively participates in ERFEN and has trained a number of staff members of the National Fisheries Institute and INOCAR.

16. Final meeting with Ecuador ERFEN Committee

At this meeting, the consultant outlined the main topics to be covered in the feasibility study and, together with the WMO representative, summarized the next steps. A special discussion was devoted to the steps Ecuador must take in order to secure regional support for a Guayaquil centre. The organizational structure of the centre was discussed and generally agreed on. Staffing and equipment requirements were discussed and estimates were given of the contributions that Ecuadorian institutions could make to the centre. These contributions would come from existing resources or might be secured through a presentation to the Government and to the private sector on agriculture and fisheries for the purposes of obtaining additional resources. Estimates are shown in table 1. This ERFEN meeting was most impressive, as it demonstrated the very strong commitment of all the relevant agencies to work together to ensure the success of the proposed new El Niño centre.

Table 1
Initial estimates of the resource requirements of the International Centre for the Research of the El Niño Phenomenon

Resources	*Source of resources, thousands of US$*			
	Host country[1]		*International*	
	Current	*Equipment*	*Consultancy-annual*	*Equipment*
Part A – Human resources				
Centre Directorate				
Director (international competition) and Executive Assistant			95	
Research and Modelling Office				
Local researchers: Principal and associate meteorologists	60			
Principal and associate oceanographers	84			
Data modelling and management expert			24	
Assistants	108			
Prediction and Applications Division				
Local researchers: Meteorologists and oceanographers	84			
Experts in applications in five fields			90	
Administration and Finance Division				
Director	18			
Accountant	12			
Secretariat	12			
Part B – Equipment and facilities				
Computer equipment				
Central computer, major work station, personal computer[2]				500
Satellite reception facilities				100
Telecommunications – GTS access, Web site	80			100
Observation systems				
Automatic coastal stations (8)				120
Floating buoys (50)				500
Attached buoys (5)				1 000
Specialized services – information	260			
Facilities and operation				
Facilities and services	170	38		
Funds for training and contracts			200	
National equipment requirements (Ecuador)				
Automatic hydrometric stations (50)[3]				400
Totals	**888**	**38**	**409**	**2 720**
Total cost of project – start-up year				**4 402**

[1] National counterpart for the start-up year.
[2] On the basis of the contribution by the United States of America to DMC in Nairobi.
[3] These stations were lost in El Niño 1997-1998 and are necessary to take advantage of the Centre.

Table 2-A

Estimates of contributions of national institutions to the International Centre for the Research of the El Niño Phenomenon

Resources	*Source of resources, thousands of US$*	
	National counterpart	
Budgetary allocations	*Current costs*	*Investment costs*
Instituto Oceanográfico de la Armada (Naval Oceanographic Institute – INOCAR)		
Local researchers: principal and associate oceanographers	60	
Assistants	24	
Administration, finance and secretariat	42	
Basic services	12	
Specialized services – information and laboratories	70	
Supplies and materials	15	
Travel and transport – research vessels	50	20
Facilities – offices		50
Acquisition of specialized equipment		50
Total	**273**	**120**
Instituto Nacional de Meteorologia e Hidrologia (National Meteorological and Hydrological Institute – INAMHI)		
Local researchers: Principal and associate meteorologists	60	
Assistants	24	
Administrative services		
Basic services		
Specialized services – information	50	
Supplies and materials	10	
Travel and transport	20	
Facilities – hydrometeorological monitoring network	20	20
Acquisition of specialized equipment		50
Total	**184**	**70**
Instituto Nacional de Pesca (National Fisheries Institute – INP)		
Local researchers: oceanographers	44	
Assistants	12	
Administrative services		
Basic services		
Specialized services – information and laboratory	40	
Supplies and materials	15	
Travel and transport – research vessels	40	20
Facilities		20
Acquisition of specialized equipment		50
Total	**151**	**90**

Table 2-B

Estimates of contributions of national institutions to the International Centre for the Research of the El Niño Phenomenon

Resources	*Source of resources, thousands of US$*	
	National counterpart	
Budgetary allocations	*Current costs*	*Investment costs*
Escuela Superior Politécnica del Litoral (Coastal Zone Polytechnic Institute – ESPOL)		
Local researchers: Meteorologists, oceanographers	46	
Assistants	12	
Administrative services		
Basic services		
Specialized services – information and research	30	
Supplies and materials	10	
Travel and transport	10	
Facilities – offices		
Acquisition of specialized equipment		20
Total	**1 086**	**20**
Universidad Católica Santiago de Guayaquil (Santiago de Guayaquil Catholic University)		
Local researchers: Meteorologists, oceanographers	24	
Assistants	12	
Administrative services		
Basic services		
Specialized services – information, laboratories and research	30	
Supplies and materials	10	
Travel and transport	10	
Facilities		
Acquisition of specialized equipment		20
Total	**86**	**20**
Universidad Estatal de Guayaquil (State University of Guayaquil)		
Local researchers: Meteorologists, oceanographers	24	
Assistants	12	
Administrative services		
Basic services		
Specialized services – information, laboratories and research	30	
Supplies and materials	10	
Travel and transport	10	
Facilities – laboratories		15
Acquisition of specialized equipment		50
Total	**86**	**65**

Table 2-C

National counterpart

Estimates of contributions of national institutions to the International Centre for the Research of the El Niño Phenomenon

(Source of resources, thousands of US$)

Contribution for the start-up year

Summary of institutional contributions	*Current costs*	*Investment costs*	*Total*
Naval Oceanographic Institute	273	120	**393**
National Meteorological and Hydrological Institute	184	70	**254**
National Fisheries Institute	151	90	**241**
Coastal Zone Polytechnic Institute	108	20	**128**
Santiago de Guayaquil Catholic University	86	20	**106**
State University of Guayaquil	86	65	**151**
Total	**888**	**385**	**1 273**

Annual contributions for the Centre

Institutional contributions	*Current costs*	*Investment costs*	*Total*
INOCAR	160	36	**196**
INAMHI	110	21	**131**
INP	76	27	**103**
ESPOL	50	6	**56**
Universidad Católica de Guayaquil	60	6	**66**
Universidad Estatal de Guayaquil	60	20	**80**
Total	**516**	**116**	**632**

National counterpart for the Centre
Period of operation: 10 years

Contributions	*Current costs*	*Investment costs*	*Total*
Start-up year	888	385	**1 273**
Operation of centre — 9-year period	4 644	1 044	**5 688**
Total	**5 532**	**1 429**	**6 961**

Table 2-D

International contributions

The International Centre for the Research of the El Niño Phenomenon

(Source of resources, thousands of US$)

Contribution for the start-up year

Summary of contribution	*Consultancy*	*Equipment*	*Total*
Human resources			
Director	95		95
Data modelling and management expert	24		24
Expert in the applications in five fields	90		90
Fund for training and contracts	200		200
Equipment			
Computer equipment		700	700
Observation system		1 620	1 620
50 automatic hydrometric stations		400	400
Total	**409**	**2 720**	**3 129**

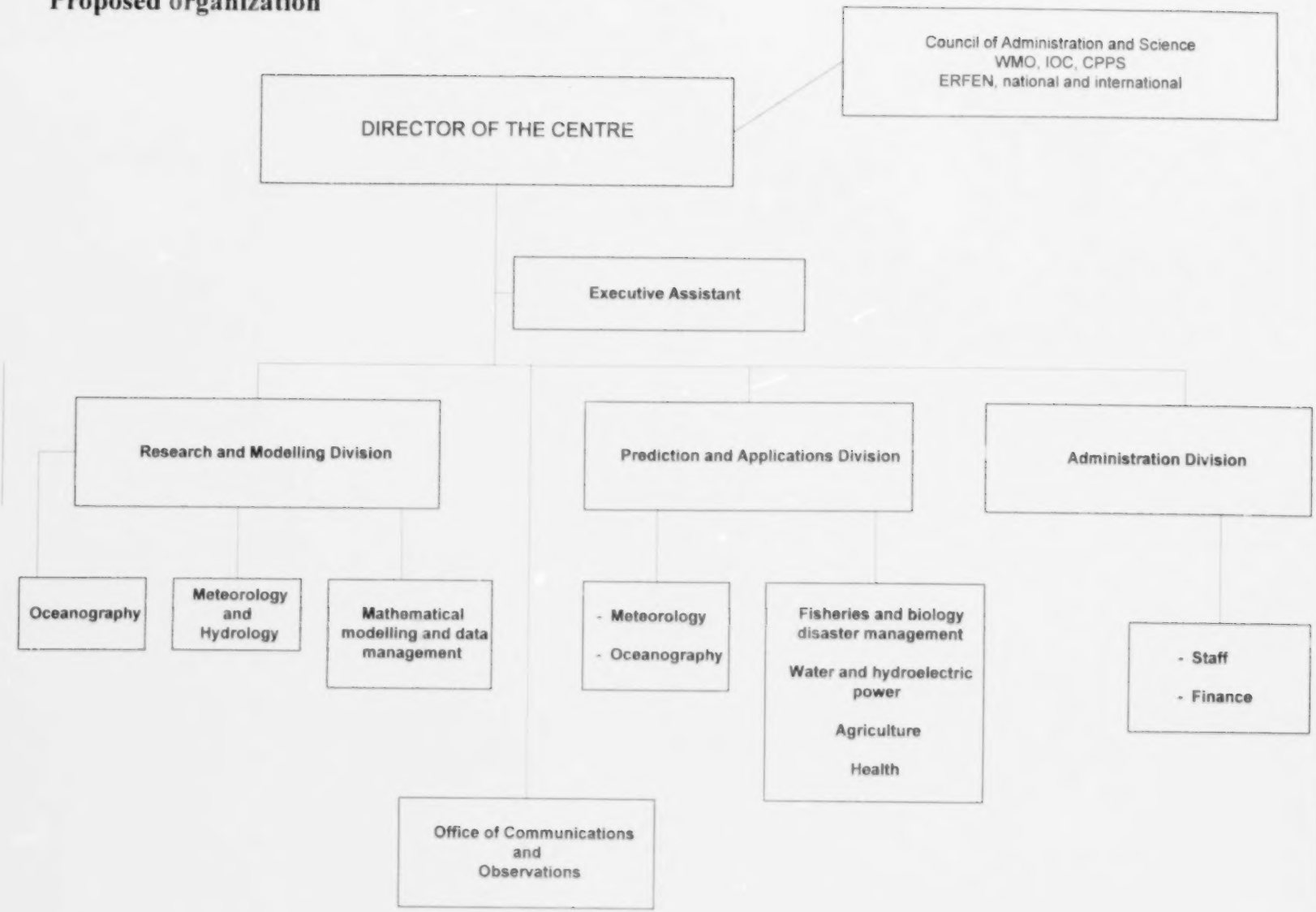
Annual contributions to the Centre

Contributions	*Consultancy*	*Equipment*	*Total*
Human resources			
Director	95		95
Experts in various fields	50		50
Total	**145**		**145**

Summary of international contribution to the Centre
Period of operation: 10 years

Contributions	*Consultancy*	*Equipment*	*Total*
Start-up year	409	2 720	3 129
Operation of the Centre for the rest of the period			
Direct — 9 years	855		855
Consultancy — 5 years	250		250
Total	**1 514**	**2 720**	**4 234**

Figure 3
Proposed organization



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United Nations A/C.2/54/7/Corr.1

General Assembly

Distr.: General
6 December 1999

English
Original: Spanish

Fifty-fourth session
Second Committee
Agenda item 100 (b)
Environment and sustainable development: International Decade for Natural Disaster Reduction

Letter dated 4 November 1999 from the Permanent Representative of Ecuador to the United Nations addressed to the Secretary-General

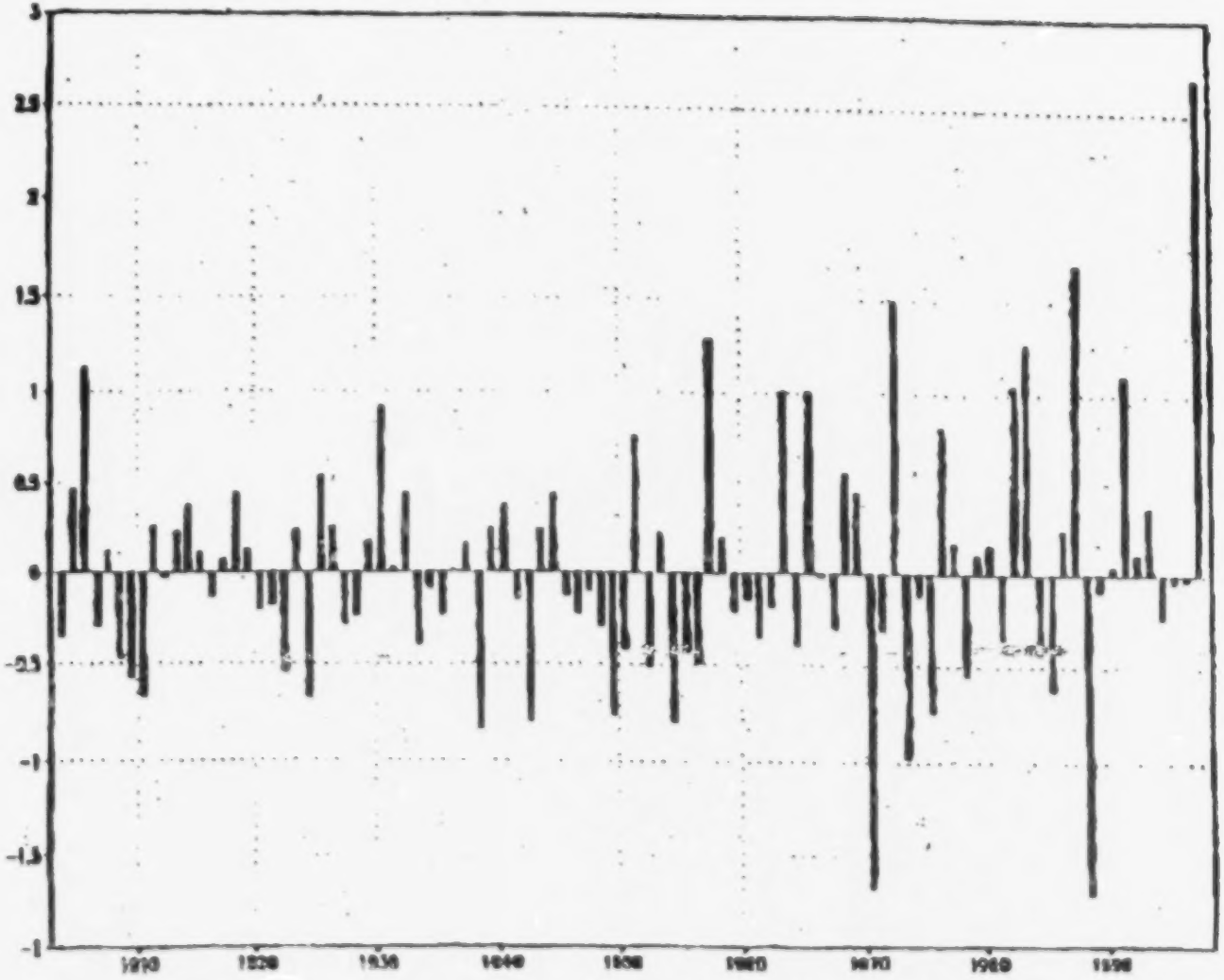
Corrigendum

Annex

Insert the attached figures before figure 3.

99-37753 (E) 081299

Figure 1. Equatorial Pacific (NIN03: 5°N-5°S, 150°W-90°W) Sea Surface Temperature Anomaly (July)



Global Sea Ice and Sea Surface Temperature 2.2 (GISST2.2) (1903-1981)

Optimally-interpolated Sea Surface Temperature (OISST) (1982-1997) using GISST2.2 1951-1980 mean

Figure 2. Malaria in Colombia

(observed data from G. Poveda)